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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary

Application No.

10/673,506

Applicant(s)

STRANG, ERIC J.

Examiner

Vuthe Siek

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 November 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-69 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-69 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/CIS) Paper No(s)/Mail Date 12/14/07.
- 4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

1. This office action is in response to application 10/673,506 and RCE with amendment filed on 11/21/2007. Claims 1-69 remain pending in the application.

Double Patenting

2. This provisional obviousness-type double patenting rejection will stand until terminal disclaimers have been filed.

Claim Rejections - 35 USC § 101

3. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

4. Claim 66 is rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. A computer readable medium as claimed may include a carrier wave (see 0105 of the specification) which is non-statutory subject matter. Recommend changing to "a physical storage medium" instead.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

Patentability shall not be negated by the manner in which the invention was made

6. Claims 1-25, 32-56 and 63-69 are rejected under 35 U.S.C. 103(a) as being obvious over Sonderman et al. (6,802,045) in view of Kee et al. (5,583,780).
7. As to claims 1, 32, 63 and 66, Sonderman et al. teach substantially similar claimed invention of a method and apparatus for analyzing a process performed by a semiconductor processing tool (Fig. 1-8 and its description) comprising inputting process data relating to an actual process performed by the semiconductor processing tool (process control environment 180 receives process data (process data relating to an actual process being by semiconductor processing tool) from the manufacturing environment 170, at least col. 3 lines 50-64; Fig. 1); inputting a first principles physical model relating to the semiconductor tool (simulation environment 210 that includes device physics model, process model and equipment model, at least see in col. 5 lines 10-67; Fig. 3); performing a first principles simulation for the actual process being performed during performance of the actual process (col. 5 lines 10-67; col. 7 lines 1-20) using the physical model to provide a first principles simulation result (simulation data output by a simulator 340 of Fig. 3; at least col. 7 lines 37-62) in accordance with the process data relating to the actual process being performed in order to simulate the actual process being performed in order to simulate the actual process being performed (col. 3 lines 50-63; col. 4 lines 48-64; col. 5 lines 10-40; col. 7 lines 4-20; Fig. 1-3, 5, 8; col. 5-7; specifically Fig. 3 describes a simulator simulates device physics model to provide a first principles simulation data result; the device physics model 310, the process model 320 and the equipment model 330 perform the functions or conditions of

the device, process, and equipment, respectively, during a particular manufacturing process, col. 5 lines 10-67; the process control environment 180 utilizes the simulation data received from the simulation environment 210 in order to make control parameter adjustment or modifications for controlling manufacturing processes, col. 5 lines 40-47; the device physics model 310 comprises components that can measure electrical characteristics of a semiconductor wafer being manufactured; the device physics model comprises components that emulate or measure growth of oxide film on a semiconductor wafer; the device physics model 310 comprises components that can model the chemical reactions that can take place on a semiconductor wafer being processed, the process model and equipment are described (col. 5 lines 47-55); and using the first principles simulation result obtained during the performance of the actual process to determine a fault (error) in the process performed by the semiconductor processing tool (Fig. 1-8, col. 5-7; specifically the simulation environment 210 includes a process control interface 350 allowing the simulation environment 210 to perform feedback corrections during the manufacturing of semiconductor wafers, col. 5 lines 18-27; the simulation environment 210 determines any error due to variations in the components in the defined models; using this error data, the system 100 of Fig. 1 performs a predictive state analysis 750 and sensitivity analysis 760 of Fig. 7; performing the predictive state analysis comprising predictive how a certain component within one of the models 310, 320, 330 behaves in response to modifications to another component in any one of the models in order to determine an optimum component levels to be implemented during manufacturing processes, described in col. 8, lines 12-

67). Sonderman et al. also teach simulating process task (actual process) to provide simulation data results to enhance manufacturing process (col. 6 lines 24-64). Specifically, Sonderman et al. teach the simulation environment including the above integrated physical model and process model that is simulated by a simulator (Fig. 3). The teachings of the simulation environment that includes device physics model, process model and equipment model (Fig. 3, col. 5 lines 10-18, lines 47-55), clearly suggest that the models must include some equations that are used for computation in order to determine electrical characteristics, growth of oxide film, control parameters and temperature. Some of equations are described in column 9. Accordingly, Examiner believes that the simulation environment that includes a physics model, process model and equipment model correspond to physics-based first principles model. The simulation environment comprises a process control interface that allows communications between the simulation environment to receive manufacturing data from the manufacturing environment which can be used by the simulation environment to perform feedback corrections during the manufacturing of semiconductor wafers. There is an interaction performance between these models (physical model, process model and equipment model). Therefore, any modifications to any one of the three models can be made and analyzed by the simulator. The process control environment (item 180 Fig. 1) utilizes the simulation data received from the simulation environment in order to make control parameter adjustments or modifications for controlling manufacturing processes. The physics model comprises components that emulate or measure growth of oxide film on a semiconductor wafer. The device physics model also

comprises components that can model the chemical reactions that can take place on a semiconductor wafer being processed. The process model and equipment model are described (col. 5 lines 47-67). Thus, Sonderman et al. do not teach the first principles physical model including a set of computer-encoded **differential equations**. Kee et al. teach modeling apparatus that include physical models including differential equation that can be used to develop real-time control systems for a particular actual thermal system for processing a silicon wafer using physically simulations (Fig. 1-2, see summary; col. 3 lines 44-50; col. 4 lines 33-38; col. 5 lines 1517; col. 5 lines 36-45; col. 7 lines 1-10). The modeling apparatus (physical models) include a set of computer-encoded differential equations of the physical model parameters to quickly account for spectral-radiation effects used in design and real-time control systems (col. 7 lines 3-44; col. 5 lines 23-67; col. 6 lines 1-67; col. 11 lines 14-67; col. 12 lines 1-67; Figs. 1-2). Columns 7-10 describe set of differential equations. Thus, the modeling apparatus includes set of differential equations (first principles physical model that includes set of differential equations) can be used with confidence to predict effects of various approximations in the radiation transport and to facilitate the design of actual thermal systems (col. 12 lines 29-41). In addition, the modeling system with differential equation executes quickly, even when processing unit 110 is implemented on workstation class computing platform. Thus, the modeling apparatus/system 101 quickly accounts for spectral-radiation effects, and, as described above, may used in design and real-time control system for processing a semiconductor wafer (col. 7 lines 3-10; col. 5 lines 15-17; col. 5 lines 36-45). With above expected results and motivation as described above,

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integrating the differential equations as taught by Kee et al. in Sonderman's first principles physical model would have been obvious to practitioners in the art at the time the invention. The new added limitation, first principles simulation result being produced in a time frame shorter in time than the actual process being performed is obvious to artisan skill in the technological art. It is well known to artisan in the art that speed of processor used to run simulation determines a time frame to produce a simulation result (first principles simulation result as taught by Sonderman). Different speed of processor is available. It is recognized to artisan skill in the art there is an advantage to obtain a simulation result ready for the actual process being performed because the simulation result is used to subsequently or sequentially or concurrently control process being performed. For at least these reasons, the newly added claimed limitation is obvious to artisan skill the art.

8. As to claims 2 and 33, Sonderman et al. teach directly inputting the data (input data, process, manufacturing data, input control parameters) relating to a process performed by the semiconductor processing tool from at least on the physical sensor and a metrology tool physically mounted on the semiconductor processing tool (Fig. 1, 7, col. 4-8).

9. As to claims 3-5 and 34-36, Sonderman et al. teach indirectly inputting the data relating to a process performed by the semiconductor processing tool from at least one of a manual input device and a database, inputting data recorded from a process previously performed by the semiconductor processing tool, inputting data set by a simulation operator (Fig. 1-3, col. 1, manual fashion and automated fashion, col.4-7).

10. As to claims 6-9 and 37-40, Sonderman et al. teach inputting data relating to at least one of the physical characteristics of the semiconductor processing tool and the semiconductor tool environment, data relating to at least one of a characteristic and a result of a process performed by the semiconductor processing tool; inputting a spatially resolved model of the geometry (modified models) of the semiconductor processing tool; inputting fundamental equations necessary to perform first principles simulation for a desired simulation result (Fig. 1-3, col. 5-9).

11. As to claims 10-13 and 41-44, Sonderman et al. performing interaction concurrently between simulation environment (first principles simulation) and the semiconductor processing tool (Fig. 2); performing simulation environment (first principles simulation) and the semiconductor processing tool (Fig. 2); performing first principles simulation using the input data to set a boundary condition and an initial condition of the first principles simulation model (Fig. 3, col. 5-8).

12. As to claims 14 and 45, Sonderman et al. teach using the simulation result (simulation data, simulation data result) to detect a fault in the process performed by the semiconductor processing tool by comparing the first principles simulation result with the input data (col. 7, Fig. 5-7).

13. As to claims 15-19 and 46-50, Sonderman et al. teach a system having a network of interconnected resources to perform at least one of the process steps as recited in Claim 1; using code parallelization among interconnected computational resources to share the computational load of the first principles simulation; sharing simulation information among interconnected resources to determine the fault in the

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process performed by the simulation processing tool; distributing simulation results among the interconnected resources to reduce redundant execution of substantially similar first principles simulations by different resources; distributing model changes among the interconnected resources to redundant refinements of first principles simulations by different resources (Fig. 1-3, computer code software is described in col. 9 starting line 58; col. 5-8).

14. As to claims 20-21 and 51-52, Sonderman et al. teach remote access (Col. 9 line 58 to col. 10 line 31). Note that a wide area network is art inherent.

15. As to claims 22 and 53, Sonderman et al. teach performing simulation utilizing a computer software code (Col. 9 line 58 to col. 10 line 31).

16. As to claims 23-25 and 54-56, Sonderman et al. teach using the first principles simulation result (simulation data set results) to classify a fault in the process performed by the semiconductor processing tool (col. 6, lines 1-35); calculating a set of perturbations solutions corresponding to the first principles simulation for input data to generate a profile data solutions to the first principles simulation, inputting the perturbation solutions to a multivariate analysis; inputting a difference between the first principles simulation result and the input data to the multivariate analysis; and utilizing the multivariate analysis to identify a correlation between the input data and the difference (defining variations into the components of defined models in order to simulate the effects of online manufacturing performance by the models; modified models) (col. 5-8).

17. As to claims 64-65, Sonderman et al. teach interaction between simulation environment, process control environment and manufacturing/processing environment (sharing computational load of the simulation, sharing simulation information among interconnected resources) (Fig. 1-3).

18. As to claims 67-69, the integrated physical model as taught by Sonderman et al. and Kee et al. corresponds to a first principles physical model as claimed as described in above rejection. The simulation environment included the above integrated physical model is simulated by a simulator (Fig. 3 of Sonderman). The simulation environment includes device physics model, process model and equipment model (Fig. 3, col. 5 lines 10-18). The simulation environment comprises a process control interface that allows communications between simulation environment to receive manufacturing data from the manufacturing environment which can be used by the simulation environment to perform feedback corrections during the manufacturing of semiconductor wafers. There is an interaction performance between these models (physical model, process model and equipment model). Therefore, any modifications to any one of the three models can be made and analyzed by the simulator. The process control environment (item 180 Fig. 1) utilizes the simulation data received from the simulation environment in order to make control parameter adjustments or modifications for controlling manufacturing processes. The physics model comprises components that emulate or measure growth of oxide film on a semiconductor wafer. The device physics model also comprises components that can model the chemical reactions that can take place on a semiconductor wafer being processed. These teachings correspond to providing for the

first principles simulation a reuse of known solutions as initial conditions for the first principles simulation because the simulation data is reused as initial conditions for the simulation environment.

19. Claims 26-31 and 57-62 are rejected under 35 U.S.C. 103(a) as being obvious over Sonderman et al. (6,802,045) in view Kee et al. (5,583,780) in further view of Fatke et al. (US 2005/0016947).

20. As to claims 26-28 and 57-59, Sonderman et al. do not explicitly teach the multivariate analysis comprising a partial least square analysis; defining a set of loading coefficients, computing at least one of mean and standard deviation values. Fatke et al. teach these limitations including defining a correlation matrix in order to improve detection of a feature etch completion process during semiconductor manufacturing to thereby providing accurate and precise completion of an etch process (see abstract, Fig. 4, summary, 0051). Therefore, it would have obvious to one of ordinary skill in the art at the time the invention was made to combine these teachings in to the system as taught by Sonderman et al. in order to provide an accurate and precise completion of a process during semiconductor manufacturing.

21. As to claims 29-31 and 60-62, Sonderman et al. attributing the difference between simulated results and input data to one input data using the correlation; using the simulation result to detect a fault comprising detecting a fault (error) in at least one of a material processing system, an etch system, a photoresist spin coating system, a lithography system, a dielectric coating system, a deposit system, a rapid thermal

processing system for thermal annealing and a batch diffusion furnace (examples described in col. 4; detecting a fault in at least one of a chemical vapor deposition system and a physical vapor deposition system (col. 4, 6, 7, 8).

Remarks

22. Examiner thanks applicants for long arguments, but they are not persuasive. Mainly, Applicants argued that Sonderman et al. do not teach or suggest performing a first principles simulation for the actual process being performed during performance of the actual process using the physical model to provide a first principles simulation result in accordance with the process data relating to the actual process being performed in order to simulate the actual process being performed. Applicants argued that the simulation process as described in Kee et al. is "a lengthy and costly intensive process" and therefore would not be compatible with real-time process control in which, as defined in the claims, a first principles simulations is performed for the actual process being performed **during performance of the actual process**. Examiner disagrees. Kee et al. teach that the conventional approach which merely solves the direct problem repeatedly, in lengthy and costly iterative process (col. 4 lines 22-38). Kee et al. clearly teach modeling apparatus 101 generates a model of a thermal system [physical model that includes set of differential equations] sufficiently rapidly to permit the model to be used in design of the thermal system as well as in the development of control software for the thermal system using real-time feed back from the modeling apparatus 101 (col. 3 lines 43-63; col. 5 lines 15-17; col. 5 lines 36-45; col. 6 lines 14-27; col. 7 lines 3-10). Clearly, Sonderman et al. teach first principles simulation that is performed for the actual

process being performed **during performance of the actual process**. Sonderman et al. teach an integrated system (Fig. 1, 2, 3, 5, 7, 8) that provides an interaction between a process control environment 180, a manufacturing/processing environment 170, and a simulation environment 210 (col. 4 lines 48-64). Fig. 3 shows performing simulation of first principles simulation. Sonderman et al. teach performing first principled simulation that is performed for the actual process being performed during performance of the actual process (col. 7 lines 1-20; col. 8 lines 1-11). Thus, it is not true that Sonderman teach only performing simulation of first principles simulation for the actual process before performance of the actual process. The integrated system described in Fig. 1, 2, 3, 5, 7 and 8) performs first principles simulation for the actual process being performed during performance of the actual process. It can be seen clearly from Fig. 1 and 2, there is interaction between a process control environment 180, a manufacturing/processing environment 170, and a simulation environment 210 (col. 4 lines 48-64). Applicants depend on Fig. 4, and argued that Sonderman et al. teach performing first principles simulation for the actual process **before** performance of the actual process. It is not true because Fig. 1 and 2 described there is interaction between the environments 170, 180 and 210. Clearly Fig. 2 shows that interaction. The environments as shown in Fig. 2 can of course be performed currently and any order. Fig. 3 shows a simulator that controls the process. Fig. 5 & 7 show application of simulation results to manufacturing parameters. For at least these reasons, the claimed invention is not allowable over Kee and Sonderman's teachings. The combination of teachings (to include differential equations from Kee) would expect desired results in real-time process control between

all these environments described in Fig. 1, 2, 3, 5, 7 and 8 of Sonderman. Applicants also argued that prior art teach away. Examiner disagrees because differential equation is useful in generating models (physics models) as taught by Sonderman. Therefore nothing that shows the prior art teaches away from the combination because of using differential equations. Applicants argued that the prior art use pre-generated model. The models as taught by Sonderman are generated and can be modified in order to provide best result. In addition, from the disclosure as a whole, Sonderman et al. teach a simulation environment that includes device physics model, process model and equipment model (Fig. 3, col. 5 lines 10-18, corresponding to a first principles physical model). The device physics model comprises components that can measure electrical characteristics of a semiconductor wafer being manufactured. The device physics model also comprises components that emulate or measure growth of oxide film on a semiconductor wafer. The device physics model also comprises components that can model the chemical reactions that can take place on a semiconductor wafer being processed (col. 5 lines 48-55). The process model and the equipment model are described (see col. 5 lines 56-67). These models clearly suggest that they must include some equations that are used for computation in order to determine electrical characteristics, growth of oxide film, control parameters and temperature. Some equations have been described (col. 9). Accordingly, Examiner believes that the simulation environment that includes a physics model, process model and equipment model correspond to physics-based first principles model. The Sonderman et al. does not teach the simulation environment (first principles physical model) including

differential equations. Kee et al. teach modeling apparatus that include physical models including differential equation that can be used to develop real-time control systems for a particular actual thermal system for processing a silicon wafer using physically simulations (Fig. 1-2, see summary; col. 3 lines 44-50; col. 4 lines 33-38; col. 5 lines 1517; col. 5 lines 36-45; col. 7 lines 1-10). The modeling apparatus (physical models) include a set of computer-encoded differential equations of the physical model parameters to quickly account for spectral-radiation effects used in design and real-time control systems (col. 7 lines 3-44; col. 5 lines 23-67; col. 6 lines 1-67; col. 11 lines 14-67; col. 12 lines 1-67; Figs. 1-2). Columns 7-10 describe set of differential equations. Thus, the modeling apparatus includes set of differential equations (first principles physical model that includes set of differential equations) can be used with confidence to predict effects of various approximations in the radiation transport and to facilitate the design of actual thermal systems (col. 12 lines 29-41). In addition, the modeling system with differential equation executes quickly, even when processing unit 110 is implemented on workstation class computing platform. Thus, the modeling apparatus/system 101 quickly accounts for spectral-radiation effects, and, as described above, may used in design and real-time control system for processing a semiconductor wafer (col. 7 lines 3-10; col. 5 lines 15-17; col. 5 lines 36-45). Thus, Kee et al. teach, as a whole, modeling apparatus that include physical models that can be used to develop real-time control systems for a particular actual thermal system for processing a silicon wafer. The modeling apparatus (physical models) include a set of computer-encoded differential equations of the physical model parameters to quickly account for spectral-

radiation effects used in design and real-time control systems for processing a silicon wafer of a semiconductor device (col. 7 lines 3-44; col. 5 lines 23-67; col. 6 lines 1-67; col. 11 lines 14-67; col. 12 lines 1-67; Figs. 1-2). Columns 7-10 describe set of differential equations. Thus, the modeling apparatus includes set of differential equations as taught by Kee (first principles physical model that includes set of differential equations) can be used with confidence to predict effects of various approximations in the radiation transport and to facilitate the design of actual thermal systems for processing a semiconductor wafer (col. 12 lines 29-41). With above expected results and motivation, integrating the differential equations as taught by Kee et al. in Sonderman's first principles physical model would have been obvious to practitioners in the art at the time the invention was made by considering the teachings as a whole from the cited references. The combined teachings, as a whole, render the claim limitation of first principles physical model including a set of computer-encoded differential equations obvious to practitioners the art at the time the invention was made. Examiner disagrees with Applicants that argued that Sonderman does not teach or suggest a first principles simulation for the actual process being performed. Sonderman et al. teach simulating the simulation environment (integrated physics model, process model and equipment model) (Fig. 3). Fig. 1 shows an integrated system 100 comprising a process control environment 180, a manufacturing/processing environment 170, and a simulation environment 210. The process control environment 180 controls the operations of the manufacturing environment 170. The process control environment comprising an APC framework and can receive data from manufacturing

environment 170 and simulation environment and make approximate change to manufacturing control parameters to affect the operations of the manufacturing environment 170 (col. 3 lines 50-63, see also col. 4 lines 47-64; col. 7 lines 1-20; this is real-time process). Accordingly, Examiner believes that Sonderman et al. teach performing first principles simulation for the actual process being performed during performance of the actual process using the physical model and using the first principles simulation result obtained during the performance of the actual process to determine a fault in the actual process performed by the semiconductor process tool.

Sonderman et al. clearly describes that the device physics model also comprises components that can model the chemical reactions that can take place on a semiconductor wafer being processed (col. 5 lines 47-55). These cited portions as taught by Sonderman et al. clearly teach the claim limitation of performing first principles simulation for the actual process being performed. Also, Examiner has interpreted the cited portion description by applicants (col. 7 lines 14-18 of Sonderman) different way from Applicants. The cited portion recited "the **defined models** (simulation environment that includes physics model, process and equipment model) **can perform a simulation as if an actual manufacturing process were being performed**" (col. 7 lines 14-18). Examiner interpreted that portion as performing the defined models (simulation environment that includes physics model, process model and equipment model corresponding to first principles simulation) as performing first principles simulation for the actual process being performed because the simulation imitates the actual process being performed. This is the fact of simulation performance. Practitioners in the art

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would recognize that performing a simulation model imitates the actual process being performed. In addition, Sonderman et al. teach the device physics model comprises components that can measure electrical characteristics of a semiconductor wafer being manufactured. The device physics model also comprises components that emulate or measure growth of oxide film on a semiconductor wafer. **The device physics model also comprises components that can model the chemical reactions that can take place on a semiconductor wafer being processed** (col. 5 lines 48-55). These teachings clearly suggest when the simulation environment is simulated by a simulator (Fig. 3), the simulation environment being performed imitates the actual process being performed. Fig. 1 shows an integrated system 100 comprising a process control environment 180, a manufacturing/processing environment 170, and a simulation environment 210. The process control environment 180 controls the operations of the manufacturing environment 170. The process control environment comprising an APC framework and can receive data from manufacturing environment 170 and simulation environment and make approximate change to manufacturing control parameters to affect the operations of the manufacturing environment 170 (col. 3 lines 50-63, see also col. 4 lines 47-64; col. 7 lines 1-20; this is real-time process). Accordingly, Examiner believes that Sonderman et al. teach performing first principles simulation for the actual process being performed during performance of the actual process using the physical model and using the first principles simulation result obtained during the performance of the actual process to determine a fault in the actual process performed by the semiconductor process tool. Applicants argued that Kee et al. teaches using predicted

model to design and control thermal process system and forced to use pre-generated model results to control process. Examiner clearly submits that Kee et al. teach using differential equations to modeling a predicted model. Sonderman may not teach using well known different equations. Sonderman teaches first principles simulation model including equations that is used to control the manufacturing process, where process parameters can be changed to improve the manufacturing process and the first principles simulation model (physical models) can be changed as well to refine the first principles simulation model in order to in turn further improve the manufacturing process. Incorporating well known differential equations and as taught by Kee in modeling the first principles simulation as taught by Sonderman would be obvious to artisan skill in the art. Examiner submits that the first principles simulation model as taught by Sonderman can be run subsequentially or concurrently or before manufacturing process to produce simulation results that are used to control manufacturing process by changing process parameters and refining the first principles simulation (physical models) in order to improve manufacturing process. The simulation result obtained as taught by the references is used to control the manufacturing process as in the instant application. The new added limitation, first principles simulation result being produced in a time frame shorter in time than the actual process being performed is obvious to artisan skill in the technological art. It is well known to artisan skill in the art that speed of processor used to run simulation determines a time frame to produce a simulation result (first principles simulation result as taught by Sonderman). Different speed of processor is available. It is recognized to artisan skill in the art there is an

advantage to obtain a simulation result ready (or time frame to produce a simulation result is shorter than the actual process being performed) for the actual process being performed because the simulation result obtained and ready that is used to subsequently or sequentially or concurrently control process being performed would obviously speed up the process. For at least these reasons, the newly added claim limitation is obvious to artisan skill the art. Regarding to provisional double patenting, Examiner acknowledges that Applicants will file terminal disclaimers upon indication of allowance subject matter. However, there is no indication of allowable subject matter of the present claims at this time.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Vuthe Siek whose telephone number is (571) 272-1906.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jack Chiang can be reached on (571) 272-7483. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Vuthe Siek/
Primary Examiner, Art Unit 2825